CBS RADIO WPGC(AM), INC
RADIO STATION WHFS
1580 KHZ 50 KW DA-D, 0.27 KW DA-N
MORNINGSIDE, MD

AMENDED APPLICATION FOR LICENSE
OCTOBER 12, 2010

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CBS RADIO WPGC(AM), INC
RADIO STATION WHFS
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RADIO STATION WHFS
MORNINGSIDE, MD

Technical Summary Statement

This amended technical summary is in support of the WHFS day and night directional antenna systems, as currently licensed by the FCC, for conversion to Method of Moments directional proof of performance.

WHFS is currently operating with STA granted April 5, 2010 to permit operation with Method of Moments parameters prior to grant of Program Test Authority by the FCC.

This FCC license authorizes operation at the existing transmitter location with 50 kW day with a directional antenna system, and 0.27 kW night operating with a directional antenna system using the same towers. No changes were made to the towers or ground system as specified in the existing station license. Operation of WHFS as described in this application is in compliance with the terms of the construction permit.

The information provided in this technical summary shows that the operating parameters for the day and night directional antenna patterns have been determined in compliance with the requirements of section 73.151(c) of the FCC rules. The system is adjusted to antenna monitor parameters within +/- 5 percent in current ratio and +/- 3 degrees in phase of the Method of Moment Model values, as specified in the FCC Rules.

The measurements and calculations contained in this amended technical summary for Radio Station WHFS were made under my direct supervision. All information contained in this report is true and correct to the best of my knowledge.

_____

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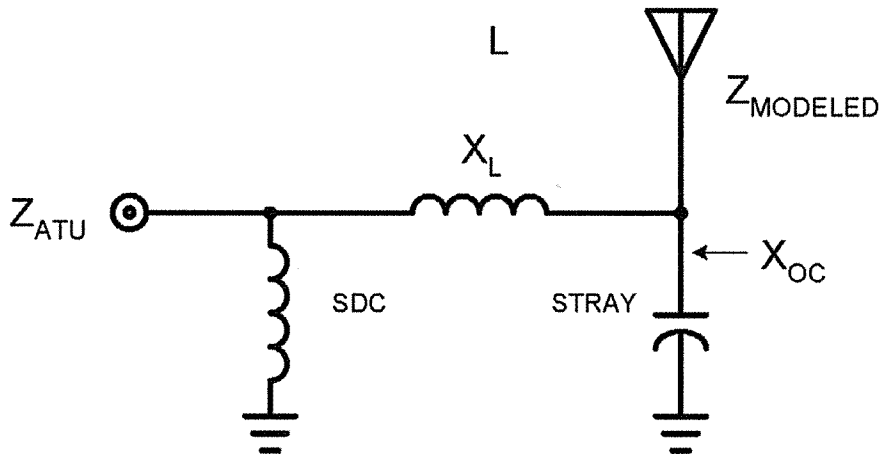
Section 1 - WHFS
Analysis of Measured Tower Impedance Data for Verification of Method of Moments Model

Tower base self impedance measurements were made at the output J-plugs inside of each Antenna Tuning Unit (ATU) with a HP model 8751A network analyzer system using an external directional coupler and power amplifier. The network analyzer system was calibrated with known standards prior to measurements. The other towers were open circuited at the output J-plug for this measurement.

The output J-plug in each ATU is located beside the toroid sampling transformer of the antenna monitor system at the output of each ATU enclosure. No components are in the circuit from this point to the tower other than static drain chokes (SDC), tubing to connect the ATU output connection to the tower (X_L), and on tower 3 an isocoupler for 950 mHz STL service which is included in the X_{OC} value for that tower. Circuit calculations were made to correlate the modeled base impedances (Zmodel) to the measured ATU output impedances (Zin). The X_{OC} value was used as a load at ground level in the open circuit unused towers for all tower self impedance models.

The measured and modeled base impedances at the ATU output J-plugs with the other tower open circuited at its ATU output J-plug agree within the FCC Rule requirement of +/- 2 ohms and +/- 4 percent for resistance and reactance.

The schematic and table below show assumed values, and the results of the WCAP calculations that were used for correlation of the model data to measured data.



TOWER	SDC	L(uH)	X_L	X_{OC}	Z (MODELED)	Z_{ATU} (MODELED)	Z_{ATU} (MEASURED)
1	+ j5350	1.895	+ j18.81	- j10,000	55.072 + j59.28	54.13 + j77.6	54.125 + j77.5
2	+ j5400	1.712	+ j17.00	- j10,000	54.061 + j61.62	53.16 + j78.1	53.180 + j78.0
3	+ j5300	2.109	+ j20.94	- j6,700	56.018 + j66.23	55.29 + j86.5	55.280 + j86.5
4	+ j5000	2.738	+ j27.18	- j10,000	51.339 + j50.01	50.28 + j76.5	50.280 + j76.5

Section 2 - WHFS
Method of Moments Model Details for Individual Tower Self Impedances

The WHFS array of towers was modeled using Expert MININEC Broadcast Professional Version 12.5. The WHFS towers are identical triangular guyed structures that are of uniform cross section construction. Each tower was modeled using 10 wire segments, with each wire segment representing the physical radius of that segment. The wire end points were specified using electrical degrees at 1580 kHz in the Geographic coordinate system with their locations taken from the theoretical directional antenna specifications. The towers are physically 90.0 degrees in electrical height, thereby each segment length is 9.00 degrees. The segment radii are specified in meters.

Each tower model was adjusted individually to provide correlation of the model impedance - when corrected by circuit calculations for the additional stray capacitances and ATU to tower connection series inductances – to the measured ATU output J-plug impedances with the other tower open circuited at its ATU output J-plug. The capacitance of the base insulator at ground level on each tower and the static drain choke reactance is included in the circuit calculations. Additionally, the shunt capacitance of an isocoupler for 950 mHz STL service located at the base of tower 3 is included in the circuit calculations.

The modeled height of each tower relative to its physical height is within the required 75 to 125 percent range and the modeled radius of each tower is within the required 80 to 150 percent of the circle radius having a circumference equal to the sum of the widths of the tower sides. The towers are of uniform cross section construction with a face width of 0.47625 meters, and a radius of 0.2274 meters.

The wire segment model, when checked using the "problem definition evaluation" function, has no errors relative to the MININEC "geometry guidelines."

The WHFS Table of Tower Physical and Model Dimensions on the following page shows each tower by segment height and radius that was used in the model.

The WHFS Tower Self Impedance Method of Moments Model Detail on the following pages list the information used in the method of moments model for each tower with the other towers open circuited.

The WHFS Tower Self Impedance WCAP Detail on the following pages list the calculations used to correct for strays and other assumed loads for each tower driven with the other towers open circuited.

WHFS Table of Tower Physical and Model Dimensions

TOWER SEGMENT	Physical Height (degrees)	Model Height (degrees)	Model Percent of Height	Model Radius (meters)	Percent Equivalent Radius
1-1	9.0	9.735	108.17	0.2501	109.98
1-2	9.0	9.735	108.17	0.2501	109.98
1-3	9.0	9.735	108.17	0.2501	109.98
1-4	9.0	9.735	108.17	0.2501	109.98
1-5	9.0	9.735	108.17	0.2501	109.98
1-6	9.0	9.735	108.17	0.2501	109.98
1-7	9.0	9.735	108.17	0.2501	109.98
1-8	9.0	9.735	108.17	0.2501	109.98
1-9	9.0	9.735	108.17	0.2501	109.98
1-10	9.0	9.735	108.17	0.2501	109.98
1 - Overall	90.0	97.35	108.17	0.2501	109.98
2-1	9.0	9.792	108.80	0.2501	109.98
2-2	9.0	9.792	108.80	0.2501	109.98
2-3	9.0	9.792	108.80	0.2501	109.98
2-4	9.0	9.792	108.80	0.2501	109.98
2-5	9.0	9.792	108.80	0.2501	109.98
2-6	9.0	9.792	108.80	0.2501	109.98
2-7	9.0	9.792	108.80	0.2501	109.98
2-8	9.0	9.792	108.80	0.2501	109.98
2-9	9.0	9.792	108.80	0.2501	109.98
2-10	9.0	9.792	108.80	0.2501	109.98
2 - Overall	90.0	97.92	108.80	0.2501	109.98
3-1	9.0	9.877	109.74	0.2501	109.98
3-2	9.0	9.877	109.74	0.2501	109.98
3-3	9.0	9.877	109.74	0.2501	109.98
3-4	9.0	9.877	109.74	0.2501	109.98
3-5	9.0	9.877	109.74	0.2501	109.98
3-6	9.0	9.877	109.74	0.2501	109.98
3-7	9.0	9.877	109.74	0.2501	109.98
3-8	9.0	9.877	109.74	0.2501	109.98
3-9	9.0	9.877	109.74	0.2501	109.98
3-10	9.0	9.877	109.74	0.2501	109.98
3 - Overall	90.0	98.77	109.74	0.2501	109.98
4-1	9.0	9.559	106.21	0.2501	109.98
4-2	9.0	9.559	106.21	0.2501	109.98
4-3	9.0	9.559	106.21	0.2501	109.98
4-4	9.0	9.559	106.21	0.2501	109.98
4-5	9.0	9.559	106.21	0.2501	109.98
4-6	9.0	9.559	106.21	0.2501	109.98
4-7	9.0	9.559	106.21	0.2501	109.98
4-8	9.0	9.559	106.21	0.2501	109.98
4-9	9.0	9.559	106.21	0.2501	109.98
4-10	9.0	9.559	106.21	0.2501	109.98
4 - Overall	90.0	95.59	106.21	0.2501	109.98

WHFS Tower 1 Self Impedance Method of Moments Model Detail
Tower 1 Driven - Other Towers Open Circuit

C:\WHFS\WHFS T1 self others open 10-12-2010 19:26:12

GEOMETRY
Wire coordinates in degrees; other dimensions in meters
Environment: perfect ground

wire	caps	Distance	Angle	Z	radius	segs
1	none	0	0	0	.2501	10
		0	0	97.35		
2	none	150.	10.	0	.2501	10
		150.	10.	97.92		
3	none	140.	45.	0	.2501	10
		140.	45.	98.77		
4	none	276.	26.88	0	.2501	10
		276.	26.88	95.59		

Number of wires = 4
current nodes = 40

	minimum		maximum	
Individual wires	wire	value	wire	value
segment length	4	9.559	3	9.877
radius	1	.2501	1	.2501

ELECTRICAL DESCRIPTION
Frequencies (MHz)

	frequency		no. of	segment length (wavelengths)	
no.	lowest	step	steps	minimum	maximum
1	1.58	1.	1	.0265528	.0274361

Sources

source	node	sector	magnitude	phase	type
1	1	1	1.	0	" voltage

Lumped loads

load	" node	resistance " (ohms)	reactance (ohms)	inductance (mH)	capccktance (uF)	passive circuit
1	11	0	-10,000.	0	0	0
2	21	0	-6,700.	0	0	0
3	31	0	-10,000.	0	0	0

IMPEDANCE
normalization = 50.

freq (MHz)	resist (ohms)	react (ohms)	imped (ohms)	phase (deg)	VSWR	S11 dB	S12 dB
source = 1; node 1, sector 1							
1.58	55.072	59.281	80.915	47.1	2.9461	-6.14	-1.2103

WHFS Tower 2 Self Impedance Method of Moments Model Detail
Tower 2 Driven - Other Towers Open Circuit

C:\WHFS\WHFS T2 self others open 10-12-2010 19:29:49

GEOMETRY
Wire coordinates in degrees; other dimensions in meters
Environment: perfect ground

wire	caps	Distance	Angle	Z	radius	segs
1	none	0	0	0	.2501	10
		0	0	97.35		
2	none	150.	10.	0	.2501	10
		150.	10.	97.92		
3	none	140.	45.	0	.2501	10
		140.	45.	98.77		
4	none	276.	26.88	0	.2501	10
		276.	26.88	95.59		

Number of wires = 4
current nodes = 40

	minimum		maximum	
Individual wires	wire	value	wire	value
segment length	4	9.559	3	9.877
radius	1	.2501	1	.2501

ELECTRICAL DESCRIPTION
Frequencies (MHz)

	frequency		no. of	segment length (wavelengths)	
no.	lowest	step	steps	minimum	maximum
1	1.58	1.	1	.0265528	.0274361

Sources

source	node	sector	magnitude	phase	type
1	11	1	1.	0	" voltage

Lumped loads

load	node	resistance " (ohms)	reactance (ohms)	inductance (mH)	capccktance (uF)	passive circuit
1	1	0	-10,000.	0	0	0
2	21	0	-6,700.	0	0	0
3	31	0	-10,000.	0	0	0

IMPEDANCE
normalization = 50.

freq (MHz)	resist (ohms)	react (ohms)	imped (ohms)	phase (deg)	VSWR	S11 dB	S12 dB
source = 1; node 11, sector 1							
1.58	54.061	61.619	81.973	48.7	3.0868	-5.838	-1.312

WHFS Tower 3 Self Impedance Method of Moments Model Detail
Tower 3 Driven - Other Towers Open Circuit

C:\WHFS\WHFS T3 self others open 10-12-2010 19:31:19

GEOMETRY
Wire coordinates in degrees; other dimensions in meters
Environment: perfect ground

wire	caps	Distance	Angle	Z	radius	segs
1	none	0	0	0	.2501	10
		0	0	97.35		
2	none	150.	10.	0	.2501	10
		150.	10.	97.92		
3	none	140.	45.	0	.2501	10
		140.	45.	98.77		
4	none	276.	26.88	0	.2501	10
		276.	26.88	95.59		

Number of wires = 4
current nodes = 40

	minimum		maximum	
Individual wires	wire	value	wire	value
segment length	4	9.559	3	9.877
radius	1	.2501	1	.2501

ELECTRICAL DESCRIPTION
Frequencies (MHz)

	frequency		no. of	segment length (wavelengths)	
no.	lowest	step	steps	minimum	maximum
1	1.58	1.	1	.0265528	.0274361

Sources

source	node	sector	magnitude	phase	type
1	21	1	1.	0	" voltage

Lumped loads

load	" node	resistance " (ohms)	reactance (ohms)	inductance (mH)	capccktance (uF)	passive circuit
1	1	0	-10,000.	0	0	0
2	11	0	-10,000.	0	0	0
3	31	0	-10,000.	0	0	0

IMPEDANCE
normalization = 50.

freq (MHz)	resist (ohms)	react (ohms)	imped (ohms)	phase (deg)	VSWR	S11 dB	S12 dB
source = 1; node 21, sector 1							
1.58	56.018	66.227	86.741	49.8	3.2734	-5.482	-1.4448

WHFS Tower 4 Self Impedance Method of Moments Model Detail
Tower 4 Driven - Other Towers Open Circuit

C:\WHFS\WHFS T4 self others open 10-12-2010 19:32:33

GEOMETRY
Wire coordinates in degrees; other dimensions in meters
Environment: perfect ground

wire	caps	Distance	Angle	Z	radius	segs
1	none	0	0	0	.2501	10
		0	0	97.35		
2	none	150.	10.	0	.2501	10
		150.	10.	97.92		
3	none	140.	45.	0	.2501	10
		140.	45.	98.77		
4	none	276.	26.88	0	.2501	10
		276.	26.88	95.59		

Number of wires = 4
current nodes = 40

	minimum		maximum	
Individual wires	wire	value	wire	value
segment length	4	9.559	3	9.877
radius	1	.2501	1	.2501

ELECTRICAL DESCRIPTION
Frequencies (MHz)

	frequency		no. of	segment length (wavelengths)	
no.	lowest	step	steps	minimum	maximum
1	1.58	1.	1	.0265528	.0274361

Sources

source	node	sector	magnitude	phase	type
1	31	1	1.	0	" voltage

Lumped loads

load	" node	resistance " (ohms)	reactance (ohms)	inductance (mH)	capccktance (uF)	passive circuit
1	11	0	-10,000.	0	0	0
2	21	0	-6,700.	0	0	0
3	1	0	-10,000.	0	0	0

IMPEDANCE
normalization = 50.

freq (MHz)	resist (ohms)	react (ohms)	imped (ohms)	phase (deg)	VSWR	S11 dB	S12 dB
source = 1; node 31, sector 1							
1.58	51.339	50.014	71.674	44.3	2.5889	-7.0773	-.94748

WHFS
WCAP Calculation Details
for Tower Self Impedance
Other Towers Open Circuit Antennas

WHFS Tower 1 Driven – Other Towers Open Circuit

```
WESTBERG CIRCUIT ANALYSIS PROGRAM


 FILE NAME = WHFS1OC.txt

I      1.0000    0    1      .0000      .0000      .0000
R      1.0000    1    2      .0000      .0000      .0000
L    538.9100    2    0      .0000      .0000      .0000
L      1.8950    2    3      .0000      .0000      .0000
C       .0000    3    0      .0000      .0000      .0000
R     55.0720    3    0    59.2810      .0000      .0000
EX      .0000    0    0      .0000      .0000      .0000


 FREQ = 1.580

   NODE       VOLT MAG      VOLT PHASE
    1         95.1619         54.5997
    2         94.5861         55.0935
    3         80.2165         47.3810
                           BRANCH VOLTAGE       BRANCH CURRENT FROM NODE IMPEDANCE  TO NODE IMPEDANCE
                           MAG      PHASE       MAG      PHASE RESISTANCE REACTANCE RESISTANCE REACTANCE
R     1-  2      1.000      1.00      .000      1.00      .000     55.13     77.57     54.13     77.57
L     2-  0    538.910     94.59    55.093       .02   -34.907       .00   5349.99       .00       .00
L     2-  3      1.895     18.54    90.588       .99      .588     55.72     78.14     55.72     59.33
C     3-  0       .000     80.22    47.381       .01   137.381       .00 -10073.10       .00       .00
R     3-  0     55.072     80.22    47.381       .99      .273     55.07     59.28       .00       .00
```

WHFS Tower 2 Driven – Other Towers Open Circuit

```
WESTBERG CIRCUIT ANALYSIS PROGRAM


 FILE NAME = WHFS2OC.txt

I      1.0000    0    1      .0000      .0000      .0000
R      1.0000    1    2      .0000      .0000      .0000
L    543.9470    2    0      .0000      .0000      .0000
L      1.7120    2    3      .0000      .0000      .0000
C       .0000    3    0      .0000      .0000      .0000
R     54.0610    3    0    61.6190      .0000      .0000
EX      .0000    0    0      .0000      .0000      .0000


 FREQ = 1.580

   NODE       VOLT MAG      VOLT PHASE
    1         95.0413         55.2592
    2         94.4750         55.7575
    3         81.2871         49.0010
                           BRANCH VOLTAGE       BRANCH CURRENT FROM NODE IMPEDANCE  TO NODE IMPEDANCE
                           MAG      PHASE       MAG      PHASE RESISTANCE REACTANCE RESISTANCE REACTANCE
R     1-  2      1.000      1.00      .000      1.00      .000     54.16     78.10     53.16     78.10
L     2-  0    543.947     94.47    55.758       .02   -34.242       .00   5400.00       .00       .00
L     2-  3      1.712     16.75    90.572       .99      .572     54.73     78.70     54.73     61.70
C     3-  0       .000     81.29    49.001       .01   139.001       .00 -10073.10       .00       .00
R     3-  0     54.061     81.29    49.001       .99      .263     54.06     61.62       .00       .00
```

WHFS Tower 3 Driven – Other Towers Open Circuit

WESTBERG CIRCUIT ANALYSIS PROGRAM

FILE NAME = WHFS3OC.txt

I	1.0000	0	1	.0000	.0000	.0000
R	1.0000	1	2	.0000	.0000	.0000
L	533.8740	2	0	.0000	.0000	.0000
L	2.1090	2	3	.0000	.0000	.0000
C	.0000	3	0	.0000	.0000	.0000
R	56.0180	3	0	66.2270	.0000	.0000
EX	.0000	0	0	.0000	.0000	.0000

FREQ = 1.580

NODE	VOLT MAG	VOLT PHASE
1	103.2142	56.9490
2	102.6722	57.4167
3	86.1769	49.8988

				BRANCH VOLTAGE MAG	BRANCH VOLTAGE PHASE	BRANCH CURRENT MAG	BRANCH CURRENT PHASE	FROM NODE IMPEDANCE RESISTANCE	FROM NODE IMPEDANCE REACTANCE	TO NODE IMPEDANCE RESISTANCE	TO NODE IMPEDANCE REACTANCE
R	1-	2	1.000	1.00	.000	1.00	.000	56.29	86.51	55.29	86.51
L	2-	0	533.874	102.67	57.417	.02	-32.583	.00	5300.00	.00	.00
L	2-	3	2.109	20.60	90.608	.98	.608	57.14	87.34	57.14	66.41
C	3-	0	.000	86.18	49.899	.01	139.899	.00	-6715.40	.00	.00
R	3-	0	56.018	86.18	49.899	.99	.125	56.02	66.23	.00	.00

WHFS Tower 4 Driven – Other Towers Open Circuit

WESTBERG CIRCUIT ANALYSIS PROGRAM

FILE NAME = WHFS4OC.txt

I	1.0000	0	1	.0000	.0000	.0000
R	1.0000	1	2	.0000	.0000	.0000
L	503.6550	2	0	.0000	.0000	.0000
L	2.7380	2	3	.0000	.0000	.0000
C	.0000	3	0	.0000	.0000	.0000
R	51.3390	3	0	50.0140	.0000	.0000
EX	.0000	0	0	.0000	.0000	.0000

FREQ = 1.580

NODE	VOLT MAG	VOLT PHASE
1	92.1143	56.1709
2	91.5614	56.6908
3	70.9316	44.5427

				BRANCH VOLTAGE MAG	BRANCH VOLTAGE PHASE	BRANCH CURRENT MAG	BRANCH CURRENT PHASE	FROM NODE IMPEDANCE RESISTANCE	FROM NODE IMPEDANCE REACTANCE	TO NODE IMPEDANCE RESISTANCE	TO NODE IMPEDANCE REACTANCE
R	1-	2	1.000	1.00	.000	1.00	.000	51.28	76.52	50.28	76.52
L	2-	0	503.655	91.56	56.691	.02	-33.309	.00	5000.00	.00	.00
L	2-	3	2.738	26.77	90.585	.98	.585	51.85	77.18	51.85	50.00
C	3-	0	.000	70.93	44.543	.01	134.543	.00	-10073.10	.00	.00
R	3-	0	51.339	70.93	44.543	.99	.292	51.34	50.01	.00	.00

Section 3 - WHFS
Computation of Operating Parameters for Day Directional Antenna

The method of moments model of the WHFS antenna array was used for day directional antenna calculations after verification of the model with the open circuit base impedance data. The complex voltage values needed at the sources located at ground level at the base of each tower to produce the current moment sums, when normalized, that are equal to the theoretical field parameters were calculated. The tower currents were then calculated from these voltage sources. The currents which are sampled by the antenna monitor system at the ATU output J-plugs were calculated from the method of moments directional antenna model using the same values of stray shunt capacitance, series inductance, and static drain inductance as used in the single tower open circuit calculations. The antenna monitor sampling lines and sampling transformers are electrically identical, and therefore the antenna monitor parameters needed to produce the theoretical antenna parameters can be calculated directly from the modeled ATU output J-plug currents. Method of moments model detail and WCAP calculations detail are included as Section 4 of this report.

TOWER	Model Current Pulse	Model Current Magnitude (amperes)	Model Current Phase (degrees)	Model Drive Impedance (ohms)	Model Drive Power (watts)
1	1	6.9713	+9.5	68.43 –j56.36	3325.61
2	11	15.0428	+42.0	101.70 +j21.28	23013.27
3	21	9.9232	+70.4	72.62 –j55.80	7151.07
4	31	22.2368	+93.9	33.39 +j32.85	16509.05

TOWER	Drive Impedance At Toroid (ohms)	Current Magnitude At Toroid (amperes)	Current Phase At Toroid (degrees)	Antenna Monitor Ratio	Antenna Monitor Phase
1	68.62 –j37.08	6.9616	+9.157	0.461	-32.3
2	100.69 +j38.92	15.1181	+41.504	1.000	0.0
3	72.37 –j34.43	9.9405	+70.237	0.658	+28.7
4	32.81 +j59.53	22.4315	+93.71	1.484	+52.2

Section 4 - WHFS
Method of Moments Model Details
for Day Directional Antenna

C:\WHFS\WHFS Day 10-12-2010 17:38:06

MEDIUM WAVE ARRAY SYNTHESIS FROM FIELD RATIOS

Frequency = 1.58 MHz

tower	field ratio magnitude	phase (deg)
1	1.	0
2	2.618	30.
3	1.451	60.
4	3.798	90.

VOLTAGES AND CURRENTS - rms

source node	voltage magnitude	phase (deg)	current magnitude	phase (deg)
1	617.93	330.	6.97951	9.6
11	1,562.86	53.9	15.0385	42.2
21	908.719	32.9	9.93466	70.5
31	1,041.43	138.4	22.2255	93.9

Sum of square of source currents = 1,735.08
Total power = 50,000. watts

TOWER ADMITTANCE MATRIX

admittance	real (mhos)	imaginary (mhos)
Y(1, 1)	.00966363	-.00680241
Y(1, 2)	.00318622	.00111411
Y(1, 3)	.00341486	.00154354
Y(1, 4)	-.000394234	-.000187292
Y(2, 1)	.00318621	.00111408
Y(2, 2)	.00694737	-.00532415
Y(2, 3)	.00358199	.00508621
Y(2, 4)	.00367063	.00201059
Y(3, 1)	.00341489	.00154345
Y(3, 2)	.00358207	.00508614
Y(3, 3)	.00649673	-.00522309
Y(3, 4)	.0031873	.0013311
Y(4, 1)	-.000394262	-.00018729
Y(4, 2)	.00367058	.00201071
Y(4, 3)	.00318722	.00133124
Y(4, 4)	.011115	-.00692606

TOWER IMPEDANCE MATRIX

impedance	real (ohms)	imaginary (ohms)
Z(1, 1)	55.1841	59.0929
Z(1, 2)	-5.10967	-27.2089
Z(1, 3)	-.635349	-29.2157
Z(1, 4)	-13.627	12.898
Z(2, 1)	-5.10944	-27.2089
Z(2, 2)	54.3805	61.5003
Z(2, 3)	28.4491	-24.3906
Z(2, 4)	-.309139	-27.8043
Z(3, 1)	-.634704	-29.2157
Z(3, 2)	28.4497	-24.3901
Z(3, 3)	56.2772	66.0863
Z(3, 4)	-4.83404	-26.8418
Z(4, 1)	-13.6269	12.8981
Z(4, 2)	-.310119	-27.8042
Z(4, 3)	-4.83519	-26.8415
Z(4, 4)	51.4711	49.8149

GEOMETRY
Wire coordinates in degrees; other dimensions in meters
Environment: perfect ground

wire	caps	Distance	Angle	Z	radius	segs
1	none	0	0	0	.2501	10
		0	0	97.35		
2	none	150.	10.	0	.2501	10
		150.	10.	97.92		
3	none	140.	45.	0	.2501	10
		140.	45.	98.77		
4	none	276.6	26.88	0	.2501	10
		276.6	26.88	95.59		

Number of wires = 4
current nodes = 40

	minimum		maximum	
Individual wires	wire	value	wire	value
segment length	4	9.559	3	9.877
radius	1	.2501	1	.2501

ELECTRICAL DESCRIPTION
Frequencies (MHz)

	frequency		no. of	segment length (wavelengths)	
no.	lowest	step	steps	minimum	maximum
1	1.58	1.	1	.0265528	.0274361

Sources

source	node	sector	magnitude	phase	type
1	1	1	873.884	330.	voltage
2	11	1	2,210.22	53.9	voltage
3	21	1	1,285.12	32.9	voltage
4	31	1	1,472.8	138.4	voltage

IMPEDANCE
normalization = 50.

freq (MHz)	resist (ohms)	react (ohms)	imped (ohms)	phase (deg)	VSWR	S11 dB	S12 dB
source = 1; node 1, sector 1							
1.58	68.429	-56.356	88.649	320.5	2.6502	-6.8956	-.99294
source = 2; node 11, sector 1							
1.58	101.7	21.277	103.91	11.8	2.1495	-8.7546	-.62086
source = 3; node 21, sector 1							
1.58	72.622	-55.803	91.586	322.5	2.6163	-6.9949	-.9678
source = 4; node 31, sector 1							
1.58	33.387	32.851	46.839	44.5	2.3941	-7.7286	-.80246

CURRENT rms
Frequency = 1.58 MHz
Input power = 50,000. watts
Efficiency = 100. %
coordinates in degrees

current no.	X	Y	Z	mag (amps)	phase (deg)	real (amps)	imaginary (amps)
GND	0	0	0	6.97133	9.5	6.87614	1.14812
2	0	0	9.735	6.53381	5.5	6.5034	.629655
3	0	0	19.47	6.09902	2.8	6.09187	.295336
4	0	0	29.205	5.58746	.4	5.5873	.0416352
5	0	0	38.94	4.99317	358.3	4.99107	-.144538
6	0	0	48.675	4.3208	356.4	4.3125	-.267628
7	0	0	58.41	3.57948	354.7	3.56421	-.330229
8	0	0	68.145	2.78016	353.1	2.75992	-.334827
9	0	0	77.88	1.93266	351.6	1.91168	-.283976
10	0	0	87.615	1.03904	350.1	1.02349	-.179086
END	0	0	97.35	0	0	0	0
GND	147.721	-26.0472	0	15.0428	42.	11.1715	10.0739
12	147.721	-26.0472	9.792	15.2416	36.6	12.2404	9.08183
13	147.721	-26.0472	19.584	15.0102	33.2	12.5601	8.21878
14	147.721	-26.0472	29.376	14.3833	30.6	12.3852	7.31344
15	147.721	-26.0472	39.168	13.3697	28.4	11.7629	6.35472
16	147.721	-26.0472	48.96	11.9859	26.5	10.7255	5.3504
17	147.721	-26.0472	58.752	10.2564	24.9	9.30488	4.3144
18	147.721	-26.0472	68.544	8.21015	23.4	7.53422	3.26223
19	147.721	-26.0472	78.336	5.87282	22.1	5.4422	2.20737
20	147.721	-26.0472	88.128	3.24608	20.8	3.03395	1.15419
END	147.721	-26.0472	97.92	0	0	0	0
GND	98.9949	-98.9949	0	9.92319	70.4	3.32733	9.34872
22	98.9949	-98.9949	9.877	9.30485	66.2	3.76012	8.51127
23	98.9949	-98.9949	19.754	8.6945	63.2	3.92379	7.75875
24	98.9949	-98.9949	29.631	7.97765	60.6	3.917	6.94982
25	98.9949	-98.9949	39.508	7.14409	58.3	3.75667	6.07663
26	98.9949	-98.9949	49.385	6.19841	56.1	3.45332	5.14732
27	98.9949	-98.9949	59.262	5.15132	54.2	3.01693	4.17543
28	98.9949	-98.9949	69.139	4.01592	52.3	2.4578	3.17597
29	98.9949	-98.9949	79.016	2.80355	50.5	1.78491	2.16194
30	98.9949	-98.9949	88.893	1.51427	48.7	.999686	1.13739
END	98.9949	-98.9949	98.77	0	0	0	0
GND	246.715	-125.057	0	22.2368	93.9	-1.50499	22.1858
32	246.715	-125.057	9.559	22.6746	92.1	-.841	22.659
33	246.715	-125.057	19.118	22.3313	91.	-.408168	22.3276
34	246.715	-125.057	28.677	21.3594	90.2	-.0740848	21.3593
35	246.715	-125.057	38.236	19.8024	89.5	.176826	19.8016
36	246.715	-125.057	47.795	17.7018	88.9	.348489	17.6983
37	246.715	-125.057	57.354	15.1043	88.3	.441947	15.0979
38	246.715	-125.057	66.913	12.0587	87.8	.45769	12.05
39	246.715	-125.057	76.472	8.60602	87.4	.395906	8.59691
40	246.715	-125.057	86.031	4.74915	86.9	.254766	4.74231
END	246.715	-125.057	95.59	0	0	0	0

WHFS
WCAP Calculation Details for Day Directional Antenna

WHFS Tower 1 Day

```
WESTBERG CIRCUIT ANALYSIS PROGRAM


 FILE NAME = WHFS1DAY.txt

I      6.9616     0     1     9.1570      .0000      .0000
R      1.0000     1     2      .0000      .0000      .0000
L    538.9100     2     0      .0000      .0000      .0000
L      1.8950     2     3      .0000      .0000      .0000
C       .0000     3     0      .0000      .0000      .0000
R     68.4290     3     0   -56.3560      .0000      .0000
EX      .0000     0     0      .0000      .0000      .0000


 FREQ = 1.580

   NODE       VOLT MAG      VOLT PHASE
    1        549.1179        -18.8836
    2        542.9833        -19.2290
    3        617.9903        -29.9741

                          BRANCH VOLTAGE        BRANCH CURRENT FROM NODE IMPEDANCE  TO NODE IMPEDANCE
                             MAG      PHASE        MAG      PHASE RESISTANCE REACTANCE RESISTANCE REACTANCE
R     1-  2      1.000       6.96      9.157       6.96      9.157     69.62    -37.08     68.62    -37.08
L     2-  0    538.910     542.98    -19.229        .10   -109.229       .00   5349.99       .00       .00
L     2-  3      1.895     131.88     99.887       7.01      9.887     67.67    -37.69     67.67    -56.50
C     3-  0       .000     617.99    -29.974        .06     60.026       .00 -10073.10       .00       .00
R     3-  0     68.429     617.99    -29.974       6.97      9.500     68.43    -56.36       .00       .00
```

WHFS Tower 2 Day

```
WESTBERG CIRCUIT ANALYSIS PROGRAM


 FILE NAME = WHFS2DAY.txt

I     15.1181     0     1    41.5040      .0000      .0000
R      1.0000     1     2      .0000      .0000      .0000
L    543.9470     2     0      .0000      .0000      .0000
L      1.7120     2     3      .0000      .0000      .0000
C       .0000     3     0      .0000      .0000      .0000
R    101.7000     3     0    21.2770      .0000      .0000
EX      .0000     0     0      .0000      .0000      .0000


 FREQ = 1.580

   NODE       VOLT MAG      VOLT PHASE
    1       1646.1030        62.4476
    2       1631.9920        62.6373
    3       1562.9740        53.8169

                          BRANCH VOLTAGE        BRANCH CURRENT FROM NODE IMPEDANCE  TO NODE IMPEDANCE
                             MAG      PHASE        MAG      PHASE RESISTANCE REACTANCE RESISTANCE REACTANCE
R     1-  2      1.000      15.12     41.504      15.12     41.504    101.69     38.92    100.69     38.92
L     2-  0    543.947    1631.99     62.637        .30    -27.363       .00   5400.00       .00       .00
L     2-  3      1.712     255.14    132.580      15.01     42.580    102.12     37.28    102.12     20.29
C     3-  0       .000    1562.97     53.817        .16    143.817       .00 -10073.10       .00       .00
R     3-  0    101.700    1562.97     53.817      15.04     42.000    101.70     21.28       .00       .00
```

WHFS Tower 3 Day

```
WESTBERG CIRCUIT ANALYSIS PROGRAM


 FILE NAME = WHFS3DAY.txt

I      9.9405    0    1    70.2370      .0000      .0000
R      1.0000    1    2       .0000      .0000      .0000
L    533.8740    2    0       .0000      .0000      .0000
L      2.1090    2    3       .0000      .0000      .0000
C       .0000    3    0       .0000      .0000      .0000
R     72.6220    3    0    -55.8030      .0000      .0000
EX      .0000    0    0       .0000      .0000      .0000


 FREQ = 1.580

   NODE       VOLT MAG      VOLT PHASE
    1        805.5891         45.0996
    2        796.6012         44.7959
    3        908.8001         32.8609

                           BRANCH VOLTAGE       BRANCH CURRENT FROM NODE IMPEDANCE  TO NODE IMPEDANCE
                           MAG      PHASE       MAG      PHASE RESISTANCE REACTANCE RESISTANCE REACTANCE
R     1-  2      1.000      9.94    70.237      9.94    70.237     73.37    -34.43     72.37    -34.43
L     2-  0    533.874    796.60    44.796       .15   -45.204       .00   5300.00       .00       .00
L     2-  3      2.109    209.49   161.014     10.01    71.014     71.42    -35.17     71.42    -56.11
C     3-  0       .000    908.80    32.861       .14   122.861       .00  -6715.40       .00       .00
R     3-  0     72.622    908.80    32.861      9.92    70.400     72.62    -55.80       .00       .00
```

WHFS Tower 4 Day

```
WESTBERG CIRCUIT ANALYSIS PROGRAM


 FILE NAME = WHFS4DAY.txt

I     22.4315    0    1    93.7100      .0000      .0000
R      1.0000    1    2       .0000      .0000      .0000
L    503.6550    2    0       .0000      .0000      .0000
L      2.7380    2    3       .0000      .0000      .0000
C       .0000    3    0       .0000      .0000      .0000
R     33.3870    3    0    32.8510      .0000      .0000
EX      .0000    0    0       .0000      .0000      .0000


 FREQ = 1.580

   NODE       VOLT MAG      VOLT PHASE
    1       1535.7780        154.1162
    2       1524.8250        154.8491
    3       1041.5700        138.4364
                           BRANCH VOLTAGE       BRANCH CURRENT FROM NODE IMPEDANCE  TO NODE IMPEDANCE
                           MAG      PHASE       MAG      PHASE RESISTANCE REACTANCE RESISTANCE REACTANCE

R     1-  2      1.000     22.43    93.710     22.43    93.710     33.81     59.53     32.81     59.53
L     2-  0    503.655   1524.83   154.849       .30    64.849       .00   5000.00       .00       .00
L     2-  3      2.738    602.47  -175.909     22.16    94.091     33.61     60.03     33.61     32.85
C     3-  0       .000   1041.57   138.436       .10  -131.564       .00 -10073.10       .00       .00
R     3-  0     33.387   1041.57   138.436     22.24    93.900     33.39     32.85       .00       .00
```

Section 5 - WHFS
Computation of Operating Parameters for Night Directional Antenna

The method of moments model of the WHFS antenna array was used for night directional antenna calculations after verification of the model with the open circuit base impedance data. The complex voltage values needed at the sources located at ground level at the base of each tower to produce the current moment sums, when normalized, that are equal to the theoretical field parameters were calculated. The tower currents were then calculated from these voltage sources. The currents which are sampled by the antenna monitor system at the ATU output J-plugs were calculated from the method of moments directional antenna model using the same values of stray shunt capacitance and series inductance as used in the single tower open circuit calculations. The antenna monitor sampling lines and sampling transformers are electrically identical, and therefore the antenna monitor parameters needed to produce the theoretical antenna parameters can be calculated directly from the modeled ATU output J-plug currents. Method of moments model detail and WCAP calculations detail are included as Section 6 of this report.

TOWER	Model Current Pulse	Model Current Magnitude (amperes)	Model Current Phase (degrees)	Model Drive Impedance (ohms)	Model Drive Power (watts)
1	1	1.08062	+12.2	108.44 +j46.83	126.63
2	11	0.835192	+69.1	93.15 +j90.74	64.97
3	21	1.02722	+137.2	43.79 +j34.78	46.21
4	31	1.14064	+194.5	24.74 +j39.62	32.19

TOWER	Drive Impedance At Toroid (ohms)	Current Magnitude At Toroid (amperes)	Current Phase At Toroid (degrees)	Antenna Monitor Ratio	Antenna Monitor Phase
1	106.80 +j66.07	1.08889	+11.662	1.000	0
2	91.14 +j107.14	0.84433	+68.648	0.775	+57.0
3	43.33 +j55.38	1.03205	+137.102	0.948	+125.4
4	24.28 +j66.13	1.15139	+194.359	1.057	-177.3

Section 6 - WHFS
Method of Moments Model Details for Night Directional Antenna

C:\WHFS\WHFS Night 10-12-2010 17:30:47

MEDIUM WAVE ARRAY SYNTHESIS FROM FIELD RATIOS

Frequency = 1.58 MHz

tower	field ratio magnitude	phase (deg)
1	1.	0
2	.84	59.4
3	.925	132.
4	1.002	191.6

VOLTAGES AND CURRENTS - rms

source node	voltage magnitude	phase (deg)	current magnitude	phase (deg)
1	127.632	35.6	1.07979	12.3
11	108.593	113.3	.833864	69.2
21	57.4337	175.7	1.02666	137.3
31	53.272	252.5	1.13991	194.5

Sum of square of source currents = 8.42943
Total power = 270. watts

TOWER ADMITTANCE MATRIX

admittance	real (mhos)	imaginary (mhos)
Y(1, 1)	.00966363	-.00680241
Y(1, 2)	.00318622	.00111411
Y(1, 3)	.00341486	.00154354
Y(1, 4)	-.000394234	-.000187292
Y(2, 1)	.00318621	.00111408
Y(2, 2)	.00694737	-.00532415
Y(2, 3)	.00358199	.00508621
Y(2, 4)	.00367063	.00201059
Y(3, 1)	.00341489	.00154345
Y(3, 2)	.00358207	.00508614
Y(3, 3)	.00649673	-.00522309
Y(3, 4)	.0031873	.0013311
Y(4, 1)	-.000394262	-.00018729
Y(4, 2)	.00367058	.00201071
Y(4, 3)	.00318722	.00133124
Y(4, 4)	.011115	-.00692606

TOWER IMPEDANCE MATRIX

impedance	real (ohms)	imaginary (ohms)
Z(1, 1)	55.1841	59.0929
Z(1, 2)	-5.10967	-27.2089
Z(1, 3)	-.635349	-29.2157
Z(1, 4)	-13.627	12.898
Z(2, 1)	-5.10944	-27.2089
Z(2, 2)	54.3805	61.5003
Z(2, 3)	28.4491	-24.3906
Z(2, 4)	-.309139	-27.8043
Z(3, 1)	-.634704	-29.2157
Z(3, 2)	28.4497	-24.3901
Z(3, 3)	56.2772	66.0863
Z(3, 4)	-4.83404	-26.8418
Z(4, 1)	-13.6269	12.8981
Z(4, 2)	-.310119	-27.8042
Z(4, 3)	-4.83519	-26.8415
Z(4, 4)	51.4711	49.8149

GEOMETRY
Wire coordinates in degrees; other dimensions in meters
Environment: perfect ground

wire	caps	Distance	Angle	Z	radius	segs
1	none	0	0	0	.2501	10
		0	0	97.35		
2	none	150.	10.	0	.2501	10
		150.	10.	97.92		
3	none	140.	45.	0	.2501	10
		140.	45.	98.77		
4	none	276.6	26.88	0	.2501	10
		276.6	26.88	95.59		

Number of wires = 4
current nodes = 40

	minimum		maximum	
Individual wires	wire	value	wire	value
segment length	4	9.559	3	9.877
radius	1	.2501	1	.2501

ELECTRICAL DESCRIPTION
Frequencies (MHz)

	frequency		no. of	segment length (wavelengths)	
no.	lowest	step	steps	minimum	maximum
1	1.58	1.	1	.0265528	.0274361

Sources

source	node	sector	magnitude	phase	type
1	1	1	180.499	35.6	voltage
2	11	1	153.574	113.3	voltage
3	21	1	81.2235	175.7	voltage
4	31	1	75.3379	252.5	voltage

IMPEDANCE
normalization = 50.

freq (MHz)	resist (ohms)	react (ohms)	imped (ohms)	phase (deg)	VSWR	S11 dB	S12 dB
source = 1; node 1, sector 1							
1.58	108.44	46.833	118.12	23.4	2.6583	-6.8724	-.99892
source = 2; node 11, sector 1							
1.58	93.146	90.737	130.04	44.2	3.9119	-4.5415	-1.8805
source = 3; node 21, sector 1							
1.58	43.789	34.776	55.918	38.5	2.0919	-9.0407	-.57853
source = 4; node 31, sector 1							
1.58	24.74	39.619	46.709	58.	3.499	-5.107	-1.6023

CURRENT rms
Frequency = 1.58 MHz
Input power = 270. watts
Efficiency = 100. %
coordinates in degrees

current no.	X	Y	Z	mag (amps)	phase (deg)	real (amps)	imaginary (amps)
GND	0	0	0	1.08062	12.2	1.05611	.228869
2	0	0	9.735	1.12136	6.6	1.11404	.127936
3	0	0	19.47	1.1204	3.2	1.11868	.062008
4	0	0	29.205	1.08543	.6	1.08537	.0111278
5	0	0	38.94	1.01778	358.5	1.01742	-.0270428
6	0	0	48.675	.919032	356.7	.917497	-.0530988
7	0	0	58.41	.791211	355.1	.788351	-.067217
8	0	0	68.145	.636686	353.7	.632881	-.0695047
9	0	0	77.88	.457557	352.5	.453602	-.0600313
10	0	0	87.615	.254003	351.3	.251058	-.038563
END	0	0	97.35	0	0	0	0
GND	147.721	-26.0472	0	.835192	69.1	.298427	.780055
12	147.721	-26.0472	9.792	.900516	64.4	.389666	.811843
13	147.721	-26.0472	19.584	.918572	61.7	.435104	.808986
14	147.721	-26.0472	29.376	.903123	59.8	.454392	.780487
15	147.721	-26.0472	39.168	.856491	58.3	.450506	.728438
16	147.721	-26.0472	48.96	.780484	57.	.424997	.654625
17	147.721	-26.0472	58.752	.677069	55.9	.379198	.560921
18	147.721	-26.0472	68.544	.548401	55.	.314456	.44929
19	147.721	-26.0472	78.336	.39637	54.2	.23194	.321424
20	147.721	-26.0472	88.128	.221162	53.4	.131775	.177617
END	147.721	-26.0472	97.92	0	0	0	0
GND	98.9949	-98.9949	0	1.02722	137.2	-.754299	.697291
22	98.9949	-98.9949	9.877	1.05025	134.9	-.74133	.743946
23	98.9949	-98.9949	19.754	1.03613	133.4	-.71254	.752234
24	98.9949	-98.9949	29.631	.992182	132.3	-.667744	.733855
25	98.9949	-98.9949	39.508	.920432	131.3	-.60786	.691159
26	98.9949	-98.9949	49.385	.822906	130.5	-.534239	.625909
27	98.9949	-98.9949	59.262	.701893	129.7	-.448511	.5399
28	98.9949	-98.9949	69.139	.55985	129.	-.352425	.435004
29	98.9949	-98.9949	79.016	.398927	128.4	-.247529	.312845
30	98.9949	-98.9949	88.893	.219568	127.7	-.134317	.173693
END	98.9949	-98.9949	98.77	0	0	0	0
GND	246.715	-125.057	0	1.14064	194.5	-1.1045	-.284846
32	246.715	-125.057	9.559	1.17003	193.2	-1.13927	-.266527
33	246.715	-125.057	19.118	1.15618	192.4	-1.12931	-.247818
34	246.715	-125.057	28.677	1.10855	191.8	-1.0853	-.225854
35	246.715	-125.057	38.236	1.02966	191.2	-1.00993	-.200605
36	246.715	-125.057	47.795	.921794	190.8	-.905524	-.172426
37	246.715	-125.057	57.354	.787464	190.4	-.774589	-.141817
38	246.715	-125.057	66.913	.629283	190.	-.619714	-.109321
39	246.715	-125.057	76.472	.449453	189.7	-.443081	-.0754094
40	246.715	-125.057	86.031	.248182	189.3	-.2449	-.0402282
END	246.715	-125.057	95.59	0	0	0	0

WHFS
WCAP Calculation Details for Night Directional Antenna

WHFS Tower 1 Night

```
WESTBERG CIRCUIT ANALYSIS PROGRAM


 FILE NAME = WHFS1NIT.txt

I      1.0889     0     1    11.6620      .0000      .0000
R      1.0000     1     2      .0000      .0000      .0000
L    538.9100     2     0      .0000      .0000      .0000
L      1.8950     2     3      .0000      .0000      .0000
C       .0000     3     0      .0000      .0000      .0000
R    108.4400     3     0    46.8330      .0000      .0000
EX      .0000     0     0      .0000      .0000      .0000


 FREQ = 1.580

   NODE       VOLT MAG      VOLT PHASE
    1         137.6743        43.1646
    2         136.7470        43.4030
    3         127.6456        35.5588
                           BRANCH VOLTAGE       BRANCH CURRENT FROM NODE IMPEDANCE  TO NODE IMPEDANCE
                           MAG      PHASE       MAG      PHASE RESISTANCE REACTANCE RESISTANCE REACTANCE

R     1-  2      1.000      1.09    11.662      1.09    11.662     107.80     66.07     106.80     66.07
L     2-  0    538.910    136.75    43.403       .03   -46.597        .00   5349.99        .00       .00
L     2-  3      1.895     20.24   102.820      1.08    12.820     109.44     64.68     109.44     45.87
C     3-  0       .000    127.65    35.559       .01   125.559        .00 -10073.10        .00       .00
R     3-  0    108.440    127.65    35.559      1.08    12.200     108.44     46.83        .00       .00
```

WHFS Tower 2 Night

```
WESTBERG CIRCUIT ANALYSIS PROGRAM


 FILE NAME = WHFS2NIT.txt

I       .8443     0     1    68.6480      .0000      .0000
R      1.0000     1     2      .0000      .0000      .0000
L    543.9470     2     0      .0000      .0000      .0000
L      1.7120     2     3      .0000      .0000      .0000
C       .0000     3     0      .0000      .0000      .0000
R     93.1460     3     0    90.7370      .0000      .0000
EX      .0000     0     0      .0000      .0000      .0000


 FREQ = 1.580

   NODE       VOLT MAG      VOLT PHASE
    1         119.3068       117.9518
    2         118.7580       118.2607
    3         108.6008       113.3493
                           BRANCH VOLTAGE       BRANCH CURRENT FROM NODE IMPEDANCE  TO NODE IMPEDANCE
                           MAG      PHASE       MAG      PHASE RESISTANCE REACTANCE RESISTANCE REACTANCE

R     1-  2      1.000       .84    68.648       .84    68.648      92.14    107.14      91.14    107.14
L     2-  0    543.947    118.76   118.261       .02    28.261        .00   5400.00        .00       .00
L     2-  3      1.712     14.07   159.634       .83    69.634      94.84    107.67      94.84     90.68
C     3-  0       .000    108.60   113.349       .01  -156.651        .00 -10073.10        .00       .00
R     3-  0     93.146    108.60   113.349       .84    69.100      93.15     90.74        .00       .00
```

WHFS Tower 3 Night

```
WESTBERG CIRCUIT ANALYSIS PROGRAM


 FILE NAME = WHFS3NIT.txt

I      1.0321     0     1  137.1020      .0000      .0000
R      1.0000     1     2     .0000      .0000      .0000
L    533.8740     2     0     .0000      .0000      .0000
L      2.1090     2     3     .0000      .0000      .0000
C       .0000     3     0     .0000      .0000      .0000
R     43.7890     3     0   34.7760      .0000      .0000
EX      .0000     0     0     .0000      .0000      .0000


 FREQ = 1.580

   NODE       VOLT MAG      VOLT PHASE
    1         73.2163       -171.5701
    2         72.5758       -170.9340
    3         57.4081        175.6554
                          BRANCH VOLTAGE       BRANCH CURRENT FROM NODE IMPEDANCE  TO NODE IMPEDANCE
                          MAG      PHASE       MAG      PHASE RESISTANCE REACTANCE RESISTANCE REACTANCE

R     1-  2     1.000      1.03   137.102      1.03   137.102     44.33     55.38     43.33     55.38
L     2-  0   533.874     72.58  -170.934       .01    99.066       .00   5300.00       .00       .00
L     2-  3     2.109     21.38  -132.425      1.02   137.575     44.24     55.60     44.24     34.67
C     3-  0      .000     57.41   175.655       .01   -94.345       .00  -6715.40       .00       .00
R     3-  0    43.789     57.41   175.655      1.03   137.200     43.79     34.78       .00       .00
```

WHFS Tower 4 Night

```
WESTBERG CIRCUIT ANALYSIS PROGRAM


 FILE NAME = WHFS4NIT.txt

I      1.1514     0     1  194.3590      .0000      .0000
R      1.0000     1     2     .0000      .0000      .0000
L    503.6550     2     0     .0000      .0000      .0000
L      2.7380     2     3     .0000      .0000      .0000
C       .0000     3     0     .0000      .0000      .0000
R     24.7400     3     0   39.6190      .0000      .0000
EX      .0000     0     0     .0000      .0000      .0000


 FREQ = 1.580

   NODE       VOLT MAG      VOLT PHASE
    1         81.5181        -96.5620
    2         81.1141        -95.8023
    3         53.2795       -107.4829
                          BRANCH VOLTAGE       BRANCH CURRENT FROM NODE IMPEDANCE  TO NODE IMPEDANCE
                          MAG      PHASE       MAG      PHASE RESISTANCE REACTANCE RESISTANCE REACTANCE

R     1-  2     1.000      1.15  -165.641      1.15  -165.641     25.28     66.13     24.28     66.13
L     2-  0   503.655     81.11   -95.802       .02   174.198       .00   5000.00       .00       .00
L     2-  3     2.738     30.88   -75.359      1.14  -165.359     24.94     66.90     24.94     39.71
C     3-  0      .000     53.28  -107.483       .01   -17.483       .00 -10073.10       .00       .00
R     3-  0    24.740     53.28  -107.483      1.14  -165.500     24.74     39.62       .00       .00
```

Section 7 - WHFS
Sampling System Information and Measurements

The antenna sampling system uses a Potomac Instruments 1901 monitor connected to Delta TCT-1HV toroidal transformers located in the ATU enclosure at the base of each tower. The antenna sampling coaxial lines are Cablewave FLC38-50J. These lines are equal electrical length copper clad 3/8 inch foam dielectric coaxial cable. Connectors for these cables are those recommended by the manufacturer. Short flexible equal electrical length RG-8U jumpers are used in the ATU enclosures for connection to the toroidal transformers.

Sampling system impedance measurements were made with a HP model 8751A network analyzer system using an external directional coupler and power amplifier. The network analyzer system was calibrated with known standards prior to measurements. Measurements were made from the antenna monitor end of the sampling lines with the lines open circuited and with the toroid sampling transformers connected.

The table immediately below gives detail on the frequencies above and below the carrier frequency where resonance (low resistance and zero reactance) was indicated. These occur at odd multiples of 90 degrees, and the table gives data on the 90 degree and 450 degree resonant frequencies of the lines. The 450 degree frequency is closest to 1580 kHz in terms of ratio. The electrical line lengths at 1580 kHz in the table were calculated by multiplying the ratio of the two frequencies times 450.

TOWER	Sampling Line Open-Circuited Resonance Below 1580 kHz (kHz)	Sampling Line Open-Circuited Resonance Above 1580 kHz (kHz)	Sampling Line Calculated Electrical Length 1580 kHz (Degrees)	1580 kHz Measured Impedance with TCT-1HV Connected (Ohms)
1	362.3	1833.47	387.8	52.0 + j1.2
2	362.065	1833.595	387.8	51.8 + j0.7
3	362.36	1833.505	387.8	51.8 + j1.0
4	362.715	1835.01	387.5	51.9 + j1.1

The WHFS sampling lines meet the FCC Rule requirement that the measured lines be equal in length within one electrical degree.

The characteristic impedance of the WHFS sampling lines was calculated by using the formula:

$$Zo = \sqrt{(\sqrt{(R1^2 + X1^2)} \bullet \sqrt{(R2^2 + X2^2)})}$$

With R1 + X1 equal to the measured impedance at the +45 degree offset frequency and R2 + X2 equal to the measured impedance at the -45 degree offset frequency.

TOWER	+45 Degree Offset Frequency (kHz)	+45 Degree Measured Impedance (Ohms)	-45 Degree Offset Frequency (kHz)	-45 Degree Measured Impedance (Ohms)	Calculated Characteristic Impedance (Ohms)
1	1650.123	8.3 –j50.3	2016.817	10.1 +j50.5	51.2
2	1650.2355	8.3 –j50.1	2016.9545	10.0 +j50.2	51.0
3	1650.1545	8.4 –j50.2	2016.8555	10.1 +j50.5	51.2
3	1651.509	8.2 –j50.1	2018.511	10.1 +j50.3	51.1

The WHFS sampling lines meet the FCC Rule requirement that the measured characteristic impedances of the lines be equal within two ohms.

The Delta TCT-1HV toroidal sampling transformers were tested for phase and current response with a Hewlitt-Packard 8751A network analyzer in a calibrated measurement system. This was done by passing a common reference signal at 1580 kHz generated by the analyzer through the units placed side by side and feeding the output of each unit into the A and B receivers of the analyzer set up to the measure relative ratio and phase of their output voltages.

TOWER	Delta TCT-1HV Ratio (Day)	Delta TCT-1HV Phase (Day)	Delta TCT-1HV Ratio (Night)	Delta TCT-1HV Phase (Night)
1	1.000	+0.10	1.000	0.0
2	1.000	0.0	1.005	+0.02
3	1.002	+0.22	1.004	+0.18
4	1.000	+0.32	1.002	+0.28

The WHFS Delta TCT-1HV toroidal sampling transformers are within the Delta specified ratings of +/- 2 percent magnitude and +/- 3 degrees.

The WHFS antenna sampling system uses a Potomac Instruments 1901 monitor serial number 678. The operation and calibration of the monitor was verified as correct by the procedure in the manufacturer's manual.

Additionally, the operating parameters were measured with the Hewlitt-Packard 8751A network analyzer in a calibrated measurement system. The tables below show the results of those measurements compared to the antenna monitor observed indications.

WHFS OBSERVED PARAMETERS DAY

TOWER	HP 8751A Analyzer Ratio (Day)	HP 8751A Analyzer Phase (Day)	Potomac 1901 Ratio (Day)	Potomac 1901 Phase (Day)
1	0.463	-32.9	0.464	-32.8
2	1.000	0.0	1.000	0.0
3	0.664	+27.9	0.665	+27.7
4	1.478	+51.4	1.480	+51.5

WHFS OBSERVED PARAMETERS NIGHT

TOWER	HP 8751A Analyzer Ratio (Night)	HP 8751A Analyzer Phase (Night)	Potomac 1901 Ratio (Night)	Potomac 1901 Phase (Night)
1	1.000	0.0	1.000	0.0
2	0.771	+56.8	0.773	+56.9
3	0.948	+124.6	0.949	+124.7
4	1.058	-178.1	1.057	-178.0

Section 8 – WHFS
Reference Field Intensity Measurements

Reference field intensity measurements were made on radials at the azimuth bearings with specified radiation limits and on the center azimuth bearing of major lobe radial. Measurements were made at three locations on each radial with a Potomac Instruments Field Intensity Meter of known calibration. The measured field intensity, distance from the antenna, GPS coordinates, and descriptions are included in the table below.

WHFS 1580 KHz Morningside, MD

50000 W DA-D

Reference Field Strength Measurements

Radial	Point	Distance (km)	Field (mv/m)	Coordinates (NAD 27)		Description
14.0°	1	1.72	42	38-53-04.5	76-53-27.3	Entrance to Central High School
	2	2.38	25	38-53-22.8	76-53-22.7	In front of building 15 on Cindy Ln
	3	3.14	9	38-53-49.1	76-53-16.5	6901 Valley Park Rd
68.0°	1	3.48	27	38-53-51.8	76-51-23.4	In front of building 15 on Cindy Ln
	2	3.73	36	38-53-25.5	76-50-56.9	Near entrance to Coca Cola distributor
	3	4.17	30	38-53-01.5	76-51-05.8	401 Hampton Pk Blvd parking lot
141.0°	1	1.77	750	38-51-25.0	76-53-00.4	7103 Kipling Street median
	2	2.43	375	38-51-09.5	76-52-43.9	Mason St at Kirkland Ln Intersection
	3	3.12	250	38-51-51.5	76-52-25.0	3101 Ritchie Rd old white bldg
277.5°	1	2.01	370	38-52-17.7	76-55-08.6	1229 Capital Heights Blvd baseball field
	2	2.88	220	35-52-21.8	76-55-45.2	4851 Marlboro Pk
	3	3.7	140	38-52-23.4	76-56-00.7	4207 C Pear St

WHFS 1580 KHz Morningside, MD

270 W DA-N

Reference Field Strength Measurements

Radial	Point	Distance (km)	Field (mv/m)	Coordinates (NAD 27)		Description
41.5°	1	2.4	2.1	38-53-08.1	76-52-42.6	7434 Shady Glenn Terrace
	2	3.31	2.8	38-53-31.3	76-52-16.8	10970 N Quil at dead end gate
	3	4.12	1.6	38-53-49.8	76-51-53.1	End of Gibbs Way
115.5°	1	2.22	3	38-51-38.5	76-52-23.1	2117 Roslyn by stop sign
	2	2.49	1.4	38-51-35.4	76-52-12.7	2201 Oakland Way near 25 mph sign
	3	3.12	4	38-51-27.3	76-51-50.4	2302 Timbercrest Dr by 25 mph sign
183.5°	1	1.38	112	38-51-26.8	76-53-51.2	6401 Elmhurst St side of house
	2	2.38	47	38-50-54.7	76-53-54.0	6506 Laconia in front of house
	3	3.01	33	38-50-34.6	76-53-54.0	6307 Hilmar in front of bldg
254.5°	1	2.01	90	38-51-52.7	76-55-05.2	Cramer Way & Gethsemane Way intersection
	2	2.45	43	38-51-50.0	76-55-24.4	Rt 4 & Quail Ave near intersection
	3	2.86	31	38-51-45.6	76-55-41.0	2104 Lakewood St by 25 mph sign
320.5°	1	2.03	1.6	38-53-02.0	76-54-40.1	Gateway Village near hydrant
	2	2.14	1.7	38-53-03.5	76-54-44.0	Capitol Height Fire Dept parking lot
	3	2.72	2.1	38-53-18.9	76-54-57.4	5878 Southern Ave in front of business office
351.5°	1	2.08	1.65	38-53-17.0	76-53-59.5	69th St Public Works bldg behind fire station
	2	2.38	0.75	38-53-27.1	76-54-01.9	6200 Addison Rd
	3	3.39	1.9	38-53-59.5	76-54-07.9	719 71st Ave

Measurements were made May 6, 2010 by Roger DuFault using
Potomac Instruments FIM-21, SN 900 calibrated August 12,2004.

Section 9 - WHFS
Direct Measurement of Operating Power

All antenna resistance and reactance measurements were made with a HP model 8751A network analyzer system using an external directional coupler and power amplifier. The network analyzer system was calibrated with known standards prior to all measurements.

The non-directional and directional antenna resistance measurements were made at the phasor cabinet common point J-plug located near the common point current meter for operating power determination. The reactance was adjusted to provide a non-reactive load at the transmitter output connection at 1580 kHz.

Section 10 - WHFS
RFR Protection Information

The operation of WHFS at 50 kW will not result in exposure of workers or the general public to radio frequency radiation in excess of the levels specified in 47 CFR 1.1310. Fences were installed around the entire site and additionally all tower bases to comply with the minimum distance of 3 meters as specified in OET bulletin 65 for this frequency, power level, and tower height to prevent electric and magnetic exposure greater than the permissible levels. These fences limit access by the general public. If it becomes necessary for workers to enter the tower base areas for maintenance, the station will either reduce power or cease operation to provide RFR safety for the workers.

Section 11 - WHFS
Exemption from Post Construction Survey Certification Requirement

The WHFS antenna site is an existing FCC licensed facility. No changes were made to the towers or ground system as described in the station license. This application for license is for a change of operating power only on both the non-directional day and directional night operation.

WHFS is therefore exempt from the Post Construction Survey Certification Requirement of the FCC rules.

SECTION III - LICENSE APPLICATION ENGINEERING DATA

Name of Applicant
CBS RADIO WPCG(AM), INC.

PURPOSE OF AUTHORIZATION APPLIED FOR: (check one)

☑ Station License ☐ Direct Measurement of Power

1. Facilities authorized in construction permit

Call Sign	File No. of Construction Permit (if applicable)	Frequency (kHz)	Hours of Operation	Power in kilowatts	
				Night	Day
WHFS		1580	UNLIMITED	0.27	50.0

2. Station location

State	City or Town
MARYLAND	Morningside

3. Transmitter location

State	County	City or Town	Street address (or other identification)
MD	Prince Georges	Capitol Heights	1401 S Addison Rd

4. Main studio location

State	County	City or Town	Street address (or other identification)
MD	Prince Georges	Lanham	4200 Parlament Pl, Suite 300

5. Remote control point location (specify only if authorized directional antenna)

State	County	City or Town	Street address (or other identification)
MD	Prince Georges	Lanham	4200 Parlament Pl, Suite 300

6. Has type-approved stereo generating equipment been installed? ☐ Yes ☑ No

7. Does the sampling system meet the requirements of 47 C.F.R. Section 73.68? ☑ Yes ☐ No ☐ Not Applicable

Attach as an Exhibit a detailed description of the sampling system as installed. Exhibit No. SECTION 7

8. Operating constants:

RF common point or antenna current (in amperes) without modulation for night system	RF common point or antenna current (in amperes) without modulation for day system
2.41	32.4

Measured antenna or common point resistance (in ohms) at operating frequency		Measured antenna or common point reactance (in ohms) at operating frequency	
Night	Day	Night	Day
50	50	- j0	- j7

Antenna indications for directional operation

Towers	Antenna monitor Phase reading(s) in degrees		Antenna monitor sample current ratio(s)		Antenna base currents	
	Night	Day	Night	Day	Night	Day
1	0	-32.3	1.000	0.461		
2	+57.0	0	0.775	1.000		
3	+125.4	+28.7	0.948	0.658		
4	-177.3	+52.2	1.057	1.484		

Manufacturer and type of antenna monitor: Potomac Instruments 1901

SECTION III - Page 2

9. Description of antenna system ((f directional antenna is used, the information requested below should be given for each element of the array. Use separate sheets if necessary.)

Type Radiator	Overall height in meters of radiator above base insulator, or above base, if grounded.	Overall height in meters above ground (without obstruction lighting)	Overall height in meters above ground (include obstruction lighting)	If antenna is either top loaded or sectionalized, describe fully in an Exhibit.
Uniform Cross Section Guyed Towers	47.46	48.46	48.46	Exhibit No.

Excitation ☑ Series ☐ Shunt

Geographic coordinates to nearest second. For directional antenna give coordinates of center of array. For single vertical radiator give tower location.

North Latitude	38	°	52	'	07.0	"	West Longitude	76	°	53	'	49.0	"

If not fully described above, attach as an Exhibit further details and dimensions including any other antenna mounted on tower and associated isolation circuits. Exhibit No. on file - no change

Also, if necessary for a complete description, attach as an Exhibit a sketch of the details and dimensions of ground system. Exhibit No. on file - no change

10. In what respect, if any, does the apparatus constructed differ from that described in the application for construction permit or in the permit?

None

11. Give reasons for the change in antenna or common point resistance.

Adjustment to Method of Moments proof of performance operating parameters

I certify that I represent the applicant in the capacity indicated below and that I have examined the foregoing statement of technical information and that it is true to the best of my knowledge and belief.

Name (Please Print or Type)	Signature (check appropriate box below)
M Donald Crain	
Address (include ZIP Code) 5 Green Acres Drive Boiling Springs, SC 29316	Date October 12, 2010
	Telephone No. (Include Area Code) (864) 599 1819

☐ Technical Director ☐ Registered Professional Engineer

☐ Chief Operator ☑ Technical Consultant

☐ Other (specify)